

Institute: *The Franciszek Górski* Institute of Plant Physiology, Polish Academy of Sciences

Title: Plant secondary metabolites in a defense response to environmental stresses

Name of potential supervisor: dr hab. Marta Libik-Konieczny, prof IPP

Background information:

Our scientific interest is mainly focused on halophytic plants and their plasticity in the adaptation to harmful environmental conditions. Secondary metabolites produced by these plants act as osmoprotectants, oxidative stress regulators, and/or signaling molecules. Some secondary products produced by halophytes are important compounds for humans as they are a source of food additives, flavorings, and pharmaceuticals. A thorough understanding of the halophyte strategy they use to deal with the adverse scenario offers opportunities to use these mechanisms to improve crop efficiency in a rapidly changing environment. We investigate the mechanisms of ecological adaptability of halophytes at the level of plant physiology, biochemistry, and gene expression.

The main question to be addressed in the project:

Is it possible to introduce some halophytes from Mediterian coasts into the temperate climatic conditions in order to remediate the soil salinization?

Are there common secondary metabolites playing signaling function in the induction of defense response in halophytes?

Is it possible to manipulate secondary metabolism in glycophytes to produce selected secondary products known for their importance in halophyte growth and development?

Information on the methods/description of work:

We use modern techniques of photosynthetic activity analyses with an assessment of photochemical efficiency as well as the activity of photosynthetic enzyme measurements and visualization. We study also the changes in the level of oxidative cell damage and changes in the activity and amount of selected enzymatic and low-molecular antioxidants using spectrophotometric and electrophoretic analyses. Molecular analyses of the gene expression level are conducted with the use of PCR and Rt-PCR techniques. Our studies are also concentrated on the possibility of genetic manipulation of investigated plants using plant' tissue and cell transformation and plant in vitro culture tools. A comprehensive assessment of plant functioning under stressful conditions allows us to understand the processes leading to the biosynthesis and accumulation of secondary metabolites. Their level and profile are detailed analyzed with the techniques of high-performance liquid chromatography (HPLC) and gas chromatography with mass spectrometry (GC-MS).

Additional information (e.g., special requirements from the candidate):

Master of Sciences degree or appropriate in the field of biological sciences, biotechnology, agriculture. Completed internship at a research unit during studies.

Place/name of potential collaborator:

Laura Pistelli, Department of Agricultural science, Food and Agro-environment of the University of Pisa, Italy

References:

Buhmann, A., and Papenbrock, J. (2013). An economic point of view of secondary compounds in halophytes. *Functional Plant Biology*, 40, 952-967.

Flowers T.J., Colmer T.D, (2015) Plant salt tolerance: adaptations in halophytes. *Annals of Botany* 115, 327–31

Ventura, Y., Eshel, A., Pasternak, D., and Sagi, M. (2015). The development of halophyte-based agriculture: past and present. *Annals of Botany*, 115, 529-40.